PCT/NL 2004 / 000492

KONINKRIJK DER NEDERLANDEN

Bureau voor de Industriële Eigendom

Hierbij wordt verklaard, dat in Nederland op 10 juli 2003 onder nummer 1023883,

ten name van:

AB SKF

te Göteborg, Zweden (SE)

een aanvrage om octrooi werd ingediend voor:

"Bearing assembly comprising a brazed connection",

en dat de hieraan gehechte stukken overeenstemmen met de oorspronkelijk ingediende stukken.

Rijswijk, 12 augustus 2004

De Directeur van het Bureau voor de Industriële Eigendom,
voor deze,

mr. I.W. van der Eijk

1023883

Abstract

A bearing assembly comprises a rolling element bearing having an outer ring means, an inner ring means and at least one series of rolling elements which are in contact with a raceway of said ring means, as well as an auxiliary element connected to one of the ring means by a connection means. Said connection means comprises a brazed connection. For instance, the connection means and the auxiliary element connected thereto may have concentric facing surfaces which enclose a layer of brazed material.

1023883

Bearing assembly comprising a brazed connection

The invention is related to a bearing assembly, comprising a rolling element bearing having an outer ring means, an inner ring means and at least one series of rolling elements which are in contact with a raceway of said ring means, as well as an auxiliary element connected to one of the ring means by a connection means.

Such a bearing assembly is generally known in various fields. As an example, reference is made to truck hub bearing units which comprise such a bearing assembly. One of the ring means of the bearing thereof is usually connected to a steel hub which is fixed on the truck or trailer axle. By means of a nut which is screwed onto the outer threads of the steel hub, the bearing is held in place.

The screwed connection between the bearing and the steel hub is subject to varying loads, and is therefore prone to fatigue. Thus, it is necessary to apply high grade materials, such as high grade steels, in this area so as to ascertain an acceptable fatigue life. This requirement however poses a severe restriction on the choice of materials. For instance, cast iron components would not be used having regard to their less favourable fatigue behaviour. However, materials like cast iron have advantages as well, such as a better formability and relatively low cost. These advantages however cannot be used in the specific applications addressed before where fatigue plays an important role.

A further important aspect of bearing assemblies is related to the internal preload thereof. A correct preload is of the utmost importance for the performance of the bearing unit. It is therefore desirable to set the preload during the manufacturing stage of the bearing unit. Thereby, mistakes when mounting the bearing unit are avoided. Moreover, the number of pieces which make up the bearing is reduced thereby, which promotes a ready application of the bearing unit in e.g. in the case of in-line assembly at a truck or car manufacturing plant.

Such a preassembled bearing unit is often obtained by welding together the inner rings of a double row rolling element bearing unit. This is done by means of laser welding the inner rings e.g. through a hole in the outer ring. However, this leads to the possible ingress of welding spatters in the bearing space, and moreover the welding of high carbon steels has resulted in severe cracking.

The object of the invention is therefore to provide a bearing assembly which does not have said restriction concerning the application of specific materials therein, and which still satisfies the requirements as to strength, reliability and safety. This object is achieved in that the connection means comprises a brazed connection.

The technology of brazing is known per se, and entails the application of a so-called brazing material which has a melting temperature lower than the melting temperature of the materials to be joined. For instance, for connecting a cast iron hub to a steel element, a nickel based brazing material can be applied. Other combinations of metallic materials to be joined and brazing materials are known as well. The application of such a brazed connection in the field of bearing assemblies has many advantages. As addressed before already, the brazed connection may for example be used to connect high grade inserts etcetera to lower grade material components at those areas where for instance fatigue is prominent. Other specific requirements can be dealt with as well in this way, such as material density, corrosion resistance, workability etc.

The brazed connection can be carried out in several ways. According to a preferred example, the connection means and the auxiliary element connected thereto have concentric facing surfaces which enclose a layer of brazed material. After melting, the brazed material can then spread through the gap between said facing surfaces under the influence of capillary action, whereby a full joint can be ascertained.

The connection means may furthermore be equipped with a mechanical lock-up device, e.g. a screw threaded part onto which a nut or bolt is screwed, connecting the auxiliary element to said one ring means. In particular in such a case, the fatigue resistance of the connection means plays an important role. Alternatively or additionally, the connection means comprises a plastically deformed part connecting the auxiliary element to said one ring means. In such a case, the connection means comprises a material having a specific plastic behaviour, e.g. low carbon steels.

As already indicated, the connection means may comprise a relatively high grade material, e.g. a steel element etc., in particular in case the connection means comprises a safety critical element. In combination therewith, the auxiliary element may comprise a relatively low grade material, e.g. a cast iron element. Also, the connection means may comprise light weight materials such as aluminium and titanium.

The invention is furthermore related to a hub bearing unit, comprising a bearing assembly as described before, said bearing assembly comprising a rolling element

bearing having an outer ring means, an inner ring means and at least one series of rolling elements which are in contact with a raceway of said ring means, as well as a mounting flange connected to one of the ring means by a connection means. According to the invention, the connection means comprises a brazed connection. Said mounting flange may comprise for instance a wheel mounting flange, and/or a brake disc or brake drum mounting flange. Also, the connection means may be provided with torque transmitting features, e.g. keys or grooves, for connection to a drive member, e.g. a cardan joint.

According to a further possible embodiment, the inner ring means is rotatable and the outer ring means has fixtures for fixing said outer ring means to a wheel suspension. Alternatively, the outer ring means is rotatable and the inner ring means has fixtures for fixing said inner ring means to a wheel suspension.

The invention is furthermore related to a pinion bearing unit, comprising a bearing assembly as described before, said bearing assembly comprising a rolling element bearing having an outer ring means, an inner ring means and at least one series of rolling elements which are in contact with a raceway of said ring means, as well as a pinion shaft connected to the inner the ring means by a connection means, said pinion shaft supporting a pinion wheel. According to the invention, the connection means comprises a brazed connection.

For enhanced safety with respect to axial shear, the connection means may comprise a form shape, e.g. a circlip accommodated in corresponding grooves of the connection means and the respective ring means. The rolling element bearing may comprise a double row taper roller bearing, or a double row angular contact ball bearing, or a combination of a roller bearing and a ball bearing. Also, at least one sensor may be provided for monitoring a bearing condition, e.g. temperature, speed, load etc.

The invention will now be described further with reference to several embodiments shown in the drawings.

Figure 1 shows a non-driven truck hub unit, comprising a bearing assembly according to the invention.

Figure 2 shows a driven truck hub unit.

Figure 3 shows a further non-driven truck hub unit.

Figure 4 shows a further embodiment of a driven truck hub unit.

The truck hub unit shown in figure 1 comprises a bearing assembly 1 according to the invention, connected to the steel hub member 2 which is to be fixed to the wheel suspension (not shown). Onto the bearing assembly 1, a wheel flange 3 as well as a brake disc 4 are mounted.

The bearing assembly 1 is of a double row taper roller type, having two outer rings 5, 6 and inner rings 7, 8. Between the rings 5, 7 respectively 6, 8, series of taper rollers 9 respectively 10 are accommodated which in a manner known per se are held spaced apart by means of the cages 11 respectively 12.

For a proper performance of the bearing assembly 1, a certain axial preload should be exerted on the taper roller bearings. This axial preload is applied onto the inner rings 7, 8 by means of the nut 13, which is screwed onto the screw thread 14 of the auxiliary element 15. This auxiliary element 15 is accommodated in a correspondingly shaped hole 16 in the steel hub 2. By means of the brazed connection 17, this auxiliary element 15 is connected to the steel hub 2. Between the facing walls of the auxiliary element 15 and the hole 16 in the steel hub 2 a bracing material such a nickel compound has been made to become fluid, so that through capillary action a strong and stiff, brazed connection is obtained. It is pointed out that the melting temperature of the brazed material, such as the nickel compound, is lower than the melting temperature of the material which makes up the auxiliary element 15 and the steel of the hub 2.

For further enhancement of the safety, a circlip 18 has been applied which is accommodated in opposing grooves in the hole 16 of the steel hub 2 and in the auxiliary element 15. Said circlip 18 is joined to the connection during the brazing process.

The rotatable outer rings 5, 6 of the taper roller bearings are accommodated in an outer ring member 19, which has a internal ridge 20 against which the outer rings 5, 6 are supported. By means of the bolted connection 21, the wheel flange 3 and the brake disc 5 are connected to said outer ring member 19. The low grade hub 2 may comprise holes 22 for accommodating wires for control/monitoring purposes and for accommodating hoses so as to control tire pressure. Said hub 2 can be an integral part of the vehicle axle. Alternatively, said hub 2 may have a cylindrical and/or tapered hole or nose for mounting and centring with respect to the vehicle axle.

The embodiment of figure 2 is to some extend identical to the embodiment of figure 1. However, the wheel flange 3 and the brake disc 4 have now been integrated with a rotatable inner ring means 2. Onto this inner ring means 2, the inner rings 7, 8 are accommodated and preloaded by means of nut 14 which is screwed onto the screw thread of the auxiliary element 15. Said auxiliary element 15 comprises internal splines 23, which engage the external splines 24 of the drive means 25.

Through screw headed holes 25, the now stationary outer ring member 20 can be connected to a vehicle wheel suspension (not shown).

Figure 3 shows a further non-driven hub bearing unit, comprising a stationary outer ring member 19 which again by means of threaded holes 25 can be connected to a vehicle suspension (not shown). The inner ring member 15 is integrated with the wheel flange 3, whereas the brake disc 4 is connected to the outwardly pointing flange 27 of the inner ring member 15 by means of a bolted connected 28. Onto the inner ring member 29, the auxiliary element 15 is connected by means of a brazed connection 17. The inward end 30 of the auxiliary element 15 has been forced outwardly so as to obtain the desired preload on the inner rings 7, 8 of the taper roller element bearings.

The embodiment of figure 4 shows a driven truck hub unit. The auxiliary element 2 has a through going hole 30 through which the axle part 31 extends. This axle part is connected on the one hand to drive shaft 32 by means of the constant velocity joint 34, and on the other hand to the wheel mounting flange 3 by means of the drive flange 35.

The rotating outer rings 5 and 6 support the wheel mounting flange 3, whereas the fixed inner rings 7, 8 are supported on the axle stub 20. Said axle stub 20 is steerable and suspended with respect to the vehicle axle 36 through the pivot 37.

Claims

1. Bearing assembly (1), comprising a rolling element bearing (5-12) having an outer ring means (5, 6), an inner ring means (7, 8) and at least one series of rolling elements (10, 11) which are in contact with a raceway of said ring means (5-8), as well as an auxiliary element (2) connected to one of the ring means (5-8) by a connection means (13-15; 30), characterised in that said connection means (13-15; 30) comprises a brazed connection (17).

2. Assembly according to claim 1, wherein the connection means (13-15; 30) and the auxiliary element (2) connected thereto have concentric facing surfaces which enclose a layer of brazed material (17).

3. Assembly according to any of the preceding claims, wherein the connection means (13-15) comprises a mechanical lock-up device, e.g. a screw threaded part (14) onto which a nut (13) or bolt is screwed, connecting the auxiliary element (2) to said at least one ring means (5-8).

4. Assembly according to any of the preceding claims, wherein the connection means (13, 14, 30) comprises a plastically deformed part (30) connecting the auxiliary element (2) to said at least one ring means (5-8).

5. Assembly according to any of the preceding claims, wherein the connection means (13-15; 30) comprises a relatively high grade material, e.g. a low carbon, high strength steel material.

6. Assembly according to any of the preceding claims, wherein the connection means (13-15; 30) comprises a safety critical element (15).

7. Assembly according to any of the preceding claims, wherein the connection means (13-15; 30) comprises a light weight material, e.g. aluminium or titanium.

8. Assembly according to any of the preceding claims, wherein the auxiliary element (2) comprises a relatively low grade, high carbon material, e.g. a cast iron element.

9. Hub bearing unit, comprising a bearing assembly (1) according to any of the preceding claims, said bearing assembly (1) comprising a rolling element bearing having an outer ring means (5, 6), an inner ring means (7, 8) and at least one series of rolling elements (9, 10) which are in contact with a raceway of said ring means (5-8), as well as a mounting flange (3, 14, 27) connected to one of the ring means (5-8) by a connection means (13-15; 30), characterised in that the connection means (13-15; 30) comprises a brazed connection (17).

10. Unit according to claim 9, wherein the mounting flange comprises a wheel mounting flange (3).

11. Unit according to claim 9 or 10, wherein the mounting flange comprises a brake disc or brake drum mounting flange (27).

12. Unit according to any of claims 9-11, wherein the auxiliary element (2) is provided with torque transmitting features, e.g. keys or grooves (23, 24), for connection to a drive member, e.g. a cardan joint (26).

13. Unit according to any of claims 9-12, wherein the inner ring means (7, 8) is rotatable and the outer ring means (5, 6) has fixtures (25) for fixing said outer ring means to a wheel suspension.

14. Unit according to any of claims 9-12, wherein the outer ring means (5, 6) is rotatable and the inner ring means (7, 8) has fixtures (2) for fixing said inner ring means (7, 8) to a wheel suspension.

15. Unit according to any of claims 9-14, wherein the auxiliary element (15) comprises a form shape, e.g. a circlip (18) accommodated in corresponding grooves of the auxiliary element (15) and the respective ring means (7, 8).

16. Unit according to any of the claims 9-15, wherein the rolling element (5-12) bearing comprises a double row taper roller bearing.

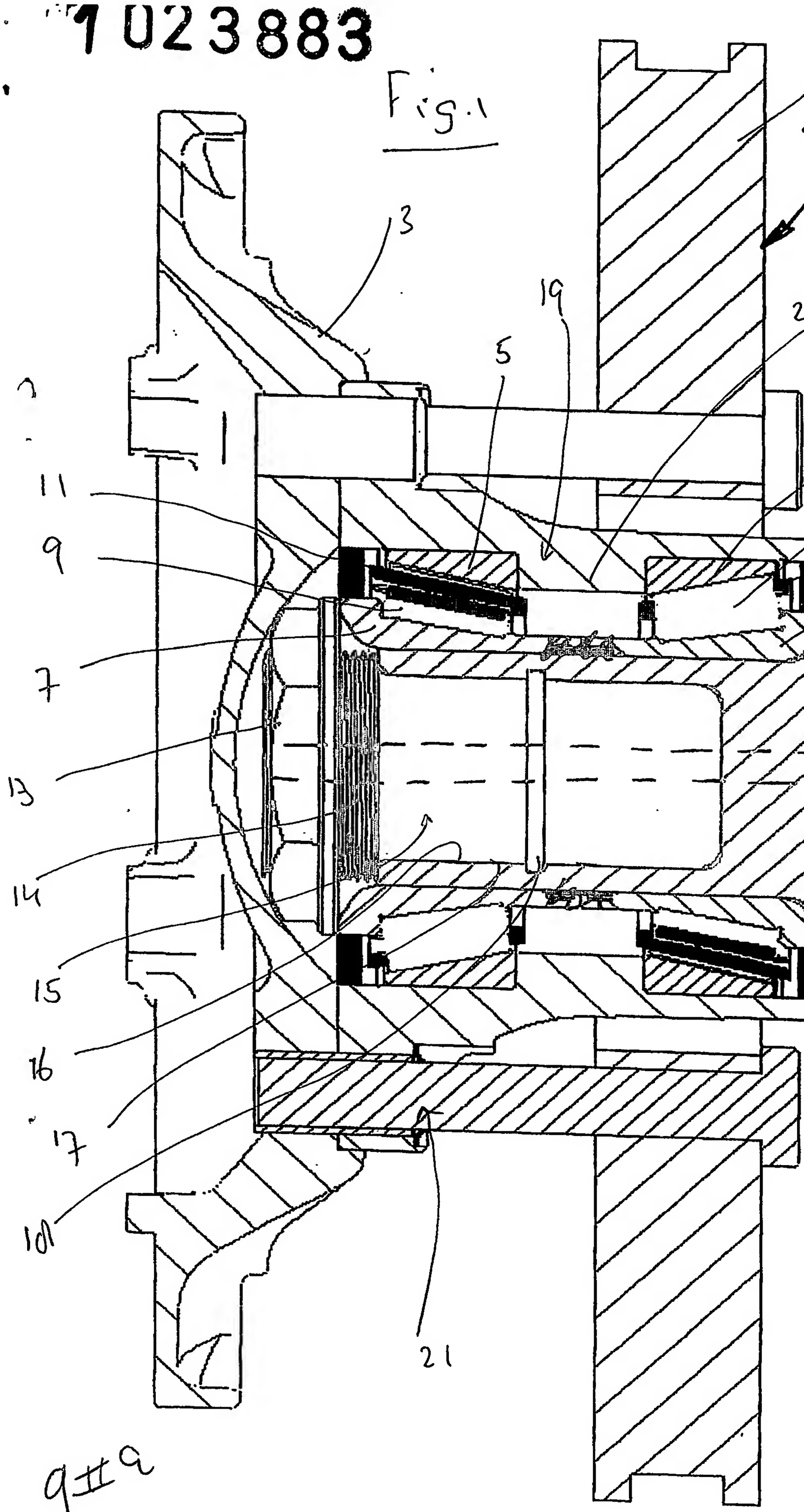
17. Unit according to any of the claims 9-16, wherein the rolling element bearing comprises a double row angular contact ball bearing.

18. Unit according to any of claims 9-17, wherein the rolling element bearing comprises a combination of a roller bearing and a ball bearing.

19. Unit according to any of claims 9-18, wherein at least one sensor is provided for monitoring a bearing condition, e.g. temperature, speed, load etc.

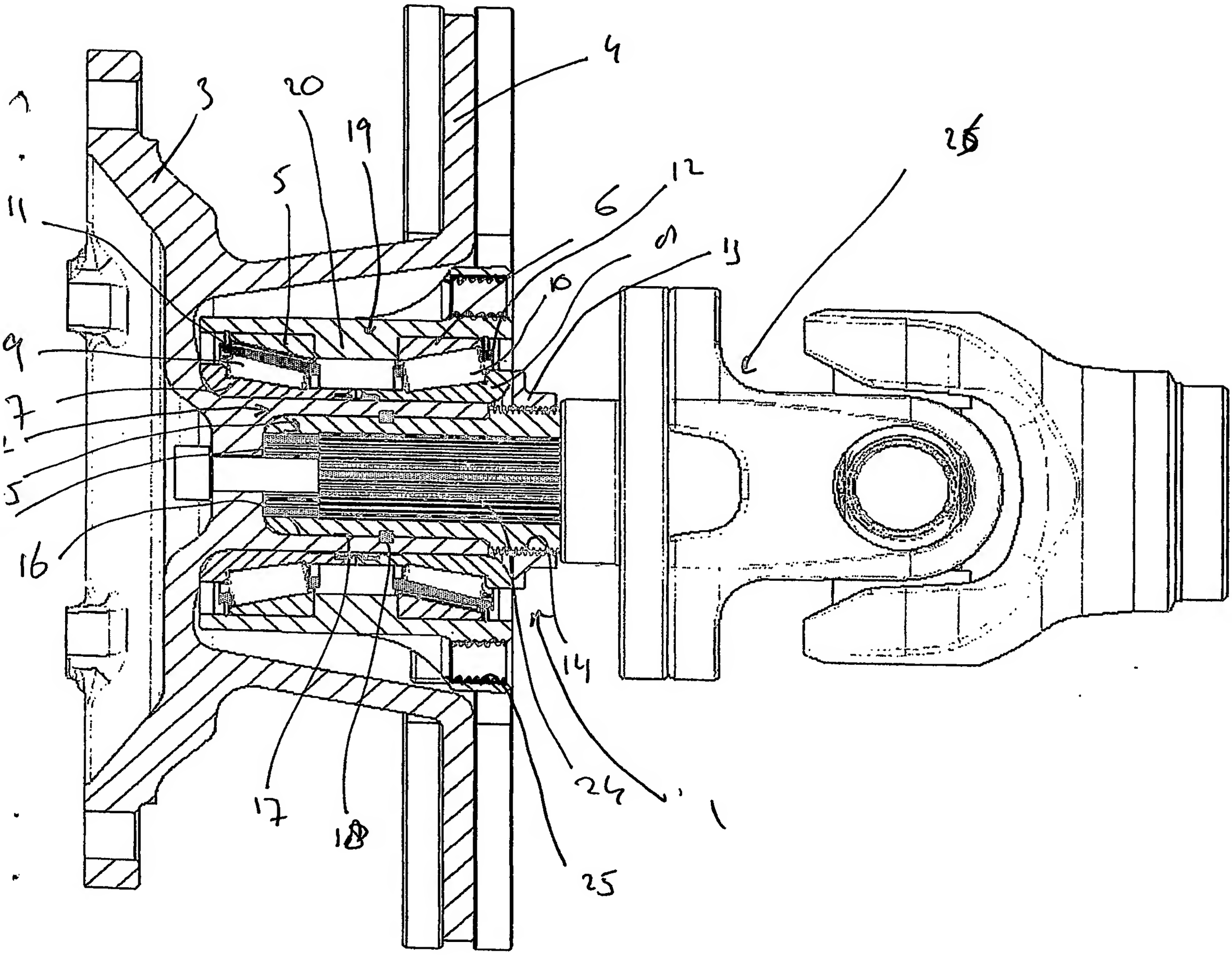
20. Pinion bearing unit, comprising a bearing assembly according to any of claims 1-8, said bearing assembly comprising a rolling element bearing having an outer ring means, an inner ring means and at least one series of rolling elements which are in contact with a raceway of said ring means, as well as a pinion shaft connected to the inner the ring means by a connection means, said pinion shaft supporting a pinion wheel, characterised in that the connection means comprises a brazed connection.

Fig. 1


4
moving brake disc
3
19
20
5
built-in/integrated Sensors eg. for speed, load, temp. etc.
6
10
1
12
2
11
9
7
13
14
15
16
17
18
21
hole(s) for wires, leads etc. for eg. a control/monitoring of tire pressure control
b
bolt hole for fixation on the suspension axle

g II a

Fig. 2



1023883

Fig.3

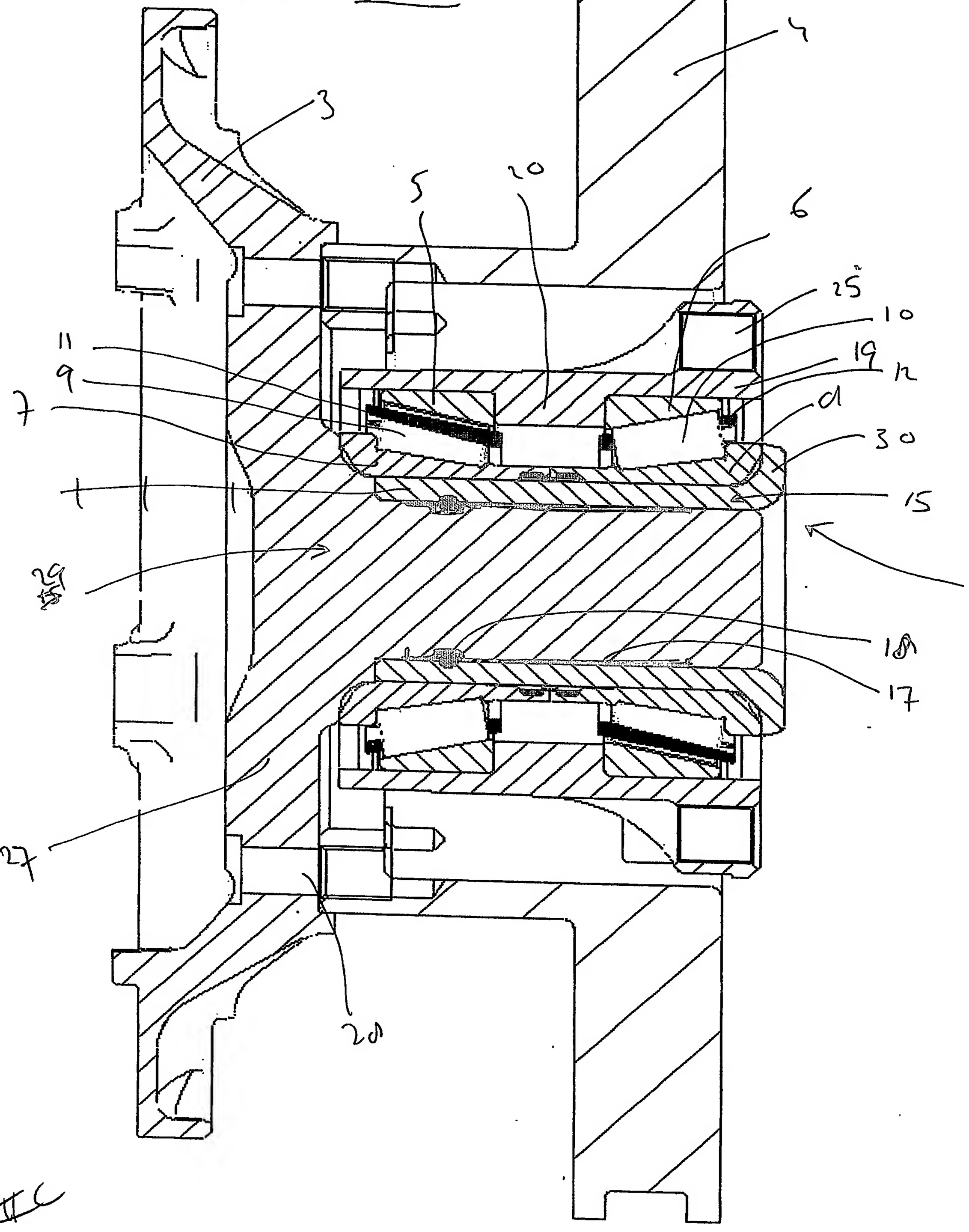
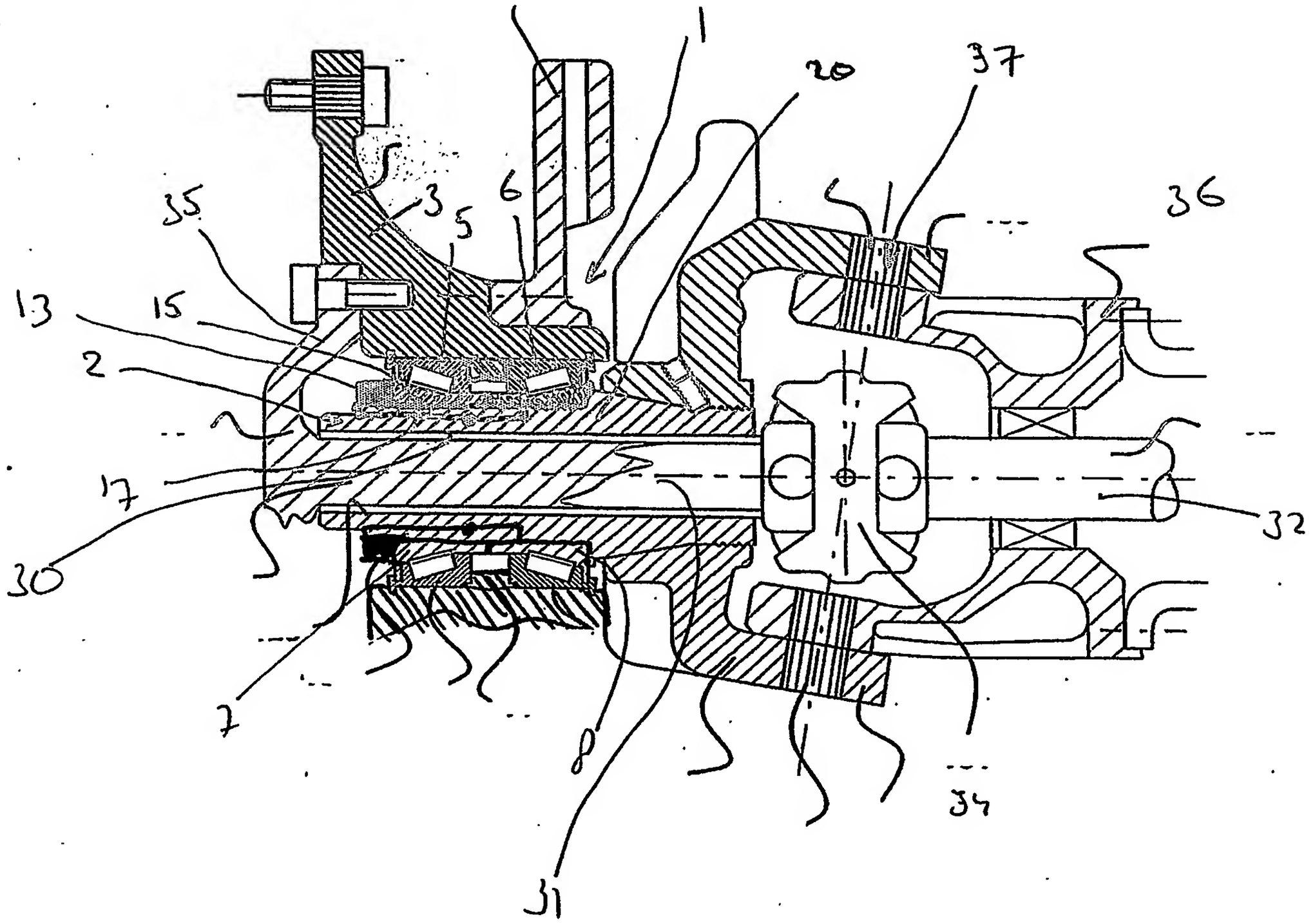


Fig. 4



gad